

**1. Work requester fills out this section.**

☐ Standing Work Permit

Requester: Don Lynch	Date: 10/9/2009	Ext.: 2253	Dept/Div/Group: PO/PHENIX
Other Contact person (if different from requester): Carter Biggs			Ext.: 7515
Work Control Coordinator: Don Lynch		Start Date: 09/28/2009	Est. End Date: 12/31/2009
Brief Description of Work: Run QC checks on RPC3 N ½ octants after installation in the RHIC Tunnel at PHENIX IR gap5 North			
Building: RHIC Tunnel	Room: PHENIX IR gap 5 North	Equipment: RPC3 N gas& elec.	Service Provider: PHENIX technicians & RPC experts

**. WCC, Requester/Designee, Service Provider, and ES&H (as necessary) fill out this section or attach analysis**

<b>ES&amp;H ANALYSIS</b>				
<b>Radiation Concerns</b>	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Activation	<input type="checkbox"/> Airborne	<input type="checkbox"/> Contamination
	<input type="checkbox"/> Radiation			
Radiation Generating Devices:	<input type="checkbox"/> Radiography	<input type="checkbox"/> Moisture Density Gauges	<input type="checkbox"/> Soil Density Gauges	<input type="checkbox"/> X-ray Equipment
<input type="checkbox"/> Special nuclear materials involved, notify Isotope Special Materials Group			<input type="checkbox"/> Fissionable materials involved, notify Laboratory Criticality Officer	
<b>Safety Concerns</b>	<input type="checkbox"/> None	<input type="checkbox"/> Ergonomics	<input type="checkbox"/> Transport of Haz/Rad Material	
<input type="checkbox"/> Adding/Removing Walls or Roofs	<input type="checkbox"/> Confined Space*	<input type="checkbox"/> Explosives	<input type="checkbox"/> Lead*	<input type="checkbox"/> Penetrating Fire Walls
	<input type="checkbox"/> Corrosive	<input type="checkbox"/> Flammable	<input type="checkbox"/> Magnetic Field*	<input checked="" type="checkbox"/> Pressurized Systems
<input type="checkbox"/> Asbestos*	<input type="checkbox"/> Cryogenic	<input type="checkbox"/> Fumes/Mist/Dust*	<input type="checkbox"/> Material Handling	<input type="checkbox"/> Rigging/Critical Lift
<input type="checkbox"/> Beryllium*	<input type="checkbox"/> Electrical	<input type="checkbox"/> Heat/Cold Stress	<input type="checkbox"/> Noise*	<input type="checkbox"/> Toxic Materials*
<input type="checkbox"/> Biohazard*	<input checked="" type="checkbox"/> Elevated Work*	<input type="checkbox"/> Hydraulic	<input type="checkbox"/> Non-ionizing Radiation*	<input type="checkbox"/> Vacuum
<input type="checkbox"/> Chemicals*	<input type="checkbox"/> Excavation	<input type="checkbox"/> Lasers*	<input type="checkbox"/> Oxygen Deficiency*	<input checked="" type="checkbox"/> Other Bottled Freon gas
* Does this work require medical clearance or surveillance from the Occupational Medicine Clinic? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				
<b>Environmental Concerns</b>	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Work impacts Environmental Permit No.		
<input type="checkbox"/> Atmospheric Discharges (rad/non-rad)	<input type="checkbox"/> Land Use	<input type="checkbox"/> Soil Activation/contamination	<input type="checkbox"/> Waste-Mixed	
<input type="checkbox"/> Chemical or Rad Material Storage or Use	<input type="checkbox"/> Liquid Discharges	<input type="checkbox"/> Waste-Clean	<input type="checkbox"/> Waste-Radioactive	
<input type="checkbox"/> Cesspools (UIC)	<input type="checkbox"/> Oil/PCB Management	<input type="checkbox"/> Waste-Hazardous	<input type="checkbox"/> Waste-Regulated Medical	
<input type="checkbox"/> High water/power consumption	<input type="checkbox"/> Spill potential	<input type="checkbox"/> Waste-Industrial	<input type="checkbox"/> Underground Duct/Piping	
Waste disposition by: <input type="checkbox"/> Other				
<b>Pollution Prevention (P2)/Waste Minimization Opportunity:</b>	<input checked="" type="checkbox"/> None <input type="checkbox"/> Yes			
<b>FACILITY CONCERNS</b>	<input checked="" type="checkbox"/> None			
<input type="checkbox"/> Access/Egress Limitations	<input type="checkbox"/> Electrical Noise	<input type="checkbox"/> Potential to Cause a False Alarm	<input type="checkbox"/> Vibrations	
	<input type="checkbox"/> Impacts Facility Use Agreement	<input type="checkbox"/> Temperature Change	<input type="checkbox"/> Other	
<input type="checkbox"/> Configuration Control	<input type="checkbox"/> Maintenance Work on Ventilation Systems	<input type="checkbox"/> Utility Interruptions		
<b>WORK CONTROLS</b>				
<b>Work Practices</b>				
<input type="checkbox"/> None	<input type="checkbox"/> Exhaust Ventilation	<input checked="" type="checkbox"/> Lockout/Tagout	<input type="checkbox"/> Spill Containment	<input type="checkbox"/> Security (see Instruction Sheet)
<input checked="" type="checkbox"/> Back-up Person/Watch	<input type="checkbox"/> HP Coverage	<input type="checkbox"/> Posting/Warning Signs	<input type="checkbox"/> Time Limitation	<input type="checkbox"/> Other
<input type="checkbox"/> Barricades	<input type="checkbox"/> IH Survey	<input type="checkbox"/> Scaffolding-requires inspection	<input type="checkbox"/> Warning Alarm (i.e. "high level")	
<b>Protective Equipment</b>				
<input type="checkbox"/> None	<input type="checkbox"/> Ear Plugs	<input type="checkbox"/> Gloves	<input type="checkbox"/> Lab Coat	<input type="checkbox"/> Safety Glasses
<input type="checkbox"/> Coveralls	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Goggles	<input type="checkbox"/> Respirator	<input checked="" type="checkbox"/> Safety Harness
<input type="checkbox"/> Disposable Clothing	<input type="checkbox"/> Face Shield	<input type="checkbox"/> Hard Hat	<input type="checkbox"/> Shoe Covers	<input checked="" type="checkbox"/> Safety Shoes <input type="checkbox"/> Other
<b>Permits Required (Permits must be valid when job is scheduled.)</b>				
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting/Welding	<input type="checkbox"/> Impair Fire Protection Systems		
<input type="checkbox"/> Concrete/Masonry Penetration	<input type="checkbox"/> Digging/Core Drilling	<input type="checkbox"/> Rad Work Permit-RWP No		
<input type="checkbox"/> Confined Space Entry	<input type="checkbox"/> Electrical Working Hot	<input type="checkbox"/> Other		
<b>Dosimetry/Monitoring</b>				
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Heat Stress Monitor	<input type="checkbox"/> Real Time Monitor	<input checked="" type="checkbox"/> TLD	
<input type="checkbox"/> Air Effluent	<input type="checkbox"/> Noise Survey/Dosimeter	<input type="checkbox"/> Self-reading Pencil Dosimeter	<input type="checkbox"/> Waste Characterization	
<input type="checkbox"/> Ground Water	<input type="checkbox"/> O <sub>2</sub> /Combustible Gas	<input type="checkbox"/> Self-reading Digital Dosimeter	<input type="checkbox"/> Other	
<input type="checkbox"/> Liquid Effluent	<input type="checkbox"/> Passive Vapor Monitor	<input type="checkbox"/> Sorbent Tube/Filter Pump		
<b>Training Requirements (List below specific training requirements)</b>				
PHENIX Awareness, LockOut/TagOut affected, Collider Accelerator worker, electrical safety				
<b>Based on analysis above, the Walkdown Team determines the risk, complexity, and coordination ratings below:</b>			<b>If using the permit when all hazard ratings are low, only the following need to sign: ( Although allowed, there is no need to use back of form)</b>	
<b>ES&amp;H Risk Level:</b>	<input checked="" type="checkbox"/> Low	<input type="checkbox"/> Moderate	<input type="checkbox"/> High	WCC: _____ Date: _____
<b>Complexity Level:</b>	<input checked="" type="checkbox"/> Low	<input type="checkbox"/> Moderate	<input type="checkbox"/> High	Service Provider: _____ Date: _____
<b>Work Coordination:</b>	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> High	Authorization to start _____ Date: _____
(Departmental Sup/WCC/Designee)				

**3. Both work requester and service provider contribute to work plan (use attachments for detailed plans)**

<b>Work Plan</b> (procedures, timing, equipment, and personnel availability need to be addressed): See Attached				
Special Working Conditions Required: No				
Operational Limits Imposed: No				
Post Work Testing Required: No				
Job Safety Analysis Required: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Walkdown Required: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Reviewed by:</b> Primary Reviewer will determine the size of the review team and the other signatures required based on hazards and job complexity. Primary Reviewer signature means that the hazards and risks that could impact ES&H have been identified and will be controlled according to BNL requirements.				
<b>Title</b>	<b>Name (print)</b>	<b>Signature</b>	<b>Life #</b>	<b>Date</b>
Primary Reviewer				
ES&H Professional				
Other				
Other				
Work Control Coordinator	Don Lynch		20146	
Service Provider				
	Review Done: <input type="checkbox"/> in series <input type="checkbox"/> team			

**4. Job site personnel fill out this section.**

Note: Signature indicates personnel performing work have read and understand the hazards and permit requirements (including any attachments).			
Job Supervisor:		Contractor Supervisor:	
Workers:	Life#:	Workers :	Life#:
Workers are encouraged to provide feedback on ES&H concerns or on ideas for improved job work flow. Use feedback form or space below.			

**5. Departmental Job Supervisor, Work Control Coordinator/Designee**

Conditions are appropriate to start work: (Permit has been reviewed, work controls are in place and site is ready for job.)			
Name:	Signature:	Life#:	Date:

**6. Departmental Job Supervisor, Work Requester/Designee determines if Post Job Review is required.** ☐ Yes ☐ No

Post Job Review (Fill in names of reviewers)			
Name:	Signature:	Life#:	Date:
Name:	Signature:	Life#:	Date:

**7. Worker provides feedback.**

Worker Feedback (use attached sheets as necessary)	
a) WCM/WCC: Is any feedback required? <input type="checkbox"/> Yes <input type="checkbox"/> No	
b) Workers: Are there better methods or safer ways to perform this job in the future? <input type="checkbox"/> Yes <input type="checkbox"/> No	

**8. Closeout: Work Control Coordinator (authorizing dept.) checks quality of completed permit and ensures the work site is left in an acceptable condition. (WCC can delegate clean up of work area to work supervisor)**

Name:	Signature:	Life#:	Date:
Comments:			

**RPC3 North Quality Control checks for installed  $\frac{1}{2}$  octants****Introduction**

In the 2009 shutdown, the PHENIX experiment has been installing the first station of the new RPC detector subassembly. This detector will be an integral part of a new fast muon trigger for the PHENIX experiment that will enable the study of flavor separated quark and anti-quark spin polarizations in the proton. A powerful way of measuring these polarizations is via single spin asymmetries for W boson production in polarized proton-proton reactions. The measurement is done by tagging  $W^+$  and  $W^-$  via their decay into high transverse momentum leptons in the forward directions. The PHENIX experiment is capable of measuring high momentum muons at forward rapidity, but the current online trigger does not have sufficient rejection to sample the rare leptons from W decay at the highest luminosities at the Relativistic Heavy Ion Collider (RHIC). Installation of the North station 3 component of the RPC detector subsystem in conjunction with the installation of the Muon Trigger FEE stations 1, 2 and 3 which was completed last year will be a major milestone in the overall project.

The physical makeup of the North station 3 component of the RPC subsystem includes 16  $\frac{1}{2}$  octant enclosures which contain independent electrical and gas systems. These are mechanically connected and supported on a common translating base structure, within the RHIC tunnel at the north end of the PHENIX experimental complex. The fully installed subsystem station is assembled into octagonal structure surrounding the beampipe.

The installation of RPC station 3 north is covered by another work permit, SS-2009-200, which has been approved and is currently in effect and guiding the installation work currently in progress.

In order to verify the mechanical, electrical and gas containment integrity of the individual  $\frac{1}{2}$  octants a set of integrity checks is to be performed immediately after installation of each  $\frac{1}{2}$  octant. These tests require the use of portable gas system and electronics equipment and is therefore beyond the scope of the existing installation work permit referred to above. This work permit is thus an addendum to the existing work permit and subject to all of the requirements of that permit in addition to those described herein.

**Work Plan**

After installation of each RPC3 North  $\frac{1}{2}$  octant and prior to the installation of the next  $\frac{1}{2}$  octant (unless otherwise approved by the PHENIX work coordinator for this permit or designated alternate), the following post-installation integrity checks (PIIC) shall be performed:

### 1. Leakage check

Using a portable Freon 134a bottle, properly seated and attached to an approved transport cart, connect each gas circuit in the ½ octant to flow Freon 134a while measuring both input and output flow rates. Gas pressure for this test shall not exceed 5 in WC, with a sustained flow rate of 30-35 cc/min per module input. Measured leak rate (difference in input to output flow rate) shall not exceed 20 cc/min per module. RPC gas system experts shall perform this test as worker planned work. Actual leak rates shall be reported to RPC experts who shall make final determination on indicated integrity.

### 2. High Voltage check

Using a portable Freon 134a bottle, properly seated and attached to an approved transport cart, connect each gas circuit in the ½ octant and flow 30-35 cc/min through each module. After flows have been established connect each module HV circuit to a portable HV source and apply 5 kV to each. Hold the HV for 1 hour, minimum, and observe dark currents generated. RPC subsystem experts shall perform this test as worker planned work. RPC subsystem experts shall determine success criteria and record results.

NOTE: The following requirements must be met before commencing the High Voltage check:

- a. The detector(s) being tested must be properly bonded by a suitable temporary safety ground to either PHENIX IR or RHIC tunnel safety ground. The temporary ground must be checked by a PHENIX electrical engineer (Steve Boose or Paul Giannotti) prior to commencing the test.
- b. High Voltage caution signs must be placed conspicuously in the immediate area of the test.
- c. The voltage and current capabilities of the HV source must be less than the design ratings for the RPC ½ octants with soft limits set to the maximum test voltage/current or equipped with hard limits on the controls set to the maximum test voltage/current.
- d. If installation of any equipment requires electrical work beyond the allowable limits defined in the PHENIX Awareness training (Voltage is less 50 V DC or AC AND maximum current is less than 5 mA or the stored energy is less than 10 Joules), BNL electricians shall perform such work and perform appropriate work planning.

### 3. LV integrity check

Maintaining Freon flow as in 2 above, power up the preamp cards and check LV distribution, signal cables, connectors, electronics and monitors for electrical anomalies, shorts, open circuits and/or excessive noise. RPC subsystem experts shall perform this

test as worker planned work. RPC subsystem experts shall determine success criteria and record results.

4. As soon as possible after the PIIC are completed, all modules in each  $\frac{1}{2}$  octant shall be attached to PHENIX gas system shared nitrogen source, with the nitrogen humidified per RPC subsystem specifications with a bubbler system. RPC gas system experts shall perform this test as worker planned work.

Note: All worker planned work in this permit shall be conducted in compliance with the limits of worker planned work described in PHENIX awareness training, including limitations on electrical work and the PHENIX 2 man rule.